

Evaluation of maternal perception of children's weight and Body Mass Index in Tuscany, Italy

Gianmarco Troiano ⁽¹⁾, Claudia M. Trombetta ⁽¹⁾, Ilaria Manini ⁽¹⁾, Rita Simi ⁽¹⁾, Veronica Meoni ⁽²⁾, Giacomo Lazzeri ⁽¹⁾

(1) Department of Molecular and Developmental Medicine, University of Siena - gianmarco.troiano@student.unisi.it

(1) Department of Molecular and Developmental Medicine, University of Siena - trombetta@unisi.it

(1) Department of Molecular and Developmental Medicine, University of Siena - ilaria.manini@unisi.it

(1) Department of Molecular and Developmental Medicine, University of Siena - simir@unisi.it

(2) Azienda USL Toscana Sud Est - veronica.meoni@uslsudest.toscana.it

(1) Department of Molecular and Developmental Medicine, University of Siena - giacomo.lazzeri@unisi.it

CORRESPONDING AUTHOR: Giacomo Lazzeri, Department of Molecular and Developmental Medicine, University of Siena, Via A. Moro 2, Siena, 53100. Italy tel. +39 0577 234156 - Email: giacomo.lazzeri@unisi.it

DOI: 10-2427/13216

Accepted on December 19, 2019

ABSTRACT

Background: The prevention of overweight is a high-priority public health task. The perception that parents have of their children's nutritional status is a well recognized risk factor for obesity in children, so the aim of our study was to evaluate mothers' perceptions of their children's nutritional status.

Methods: We conducted, in 2016, a cross-sectional study enrolling 1710 children (third grade of all primary schools) in Tuscany, as well as their mothers. Mothers' information were collected through a self-administered questionnaire, while children (weighed and measured) filled a questionnaire under the supervision of qualified personnel.

Results: 1449 children completed the questionnaire. 74.12% of mothers were able to correctly identify children BMI. The non correct classification tends to significantly decrease in presence of a high educational level compared to low educational level. Mothers' BMI seems to not be associated with misclassification. The non correct classification was significantly associated with mothers' opinion about their children's eating habit.

Conclusion: Our data confirmed that, in Tuscany, a limited percentage of mothers tend to misclassify the nutritional state of their children, but in order to maintain these encouraging results, further efforts should be done in order to make all mothers able to correctly evaluate their children.

Statements:

Authors declare no conflict of interest. The study was conducted according to the criteria set by the declaration of Helsinki and each subject signed an informed consent before participating to the study. Approval of the protocol was obtained from the institutional review board of the National Institute of Health, including the use of opt-out consent; that is, parents could refuse participation but the lack of a returned form was taken to imply consent to their child's participation

Key words: children, health promotion, body mass index, nutrition

INTRODUCTION

The prevention of overweight is a high-priority public health task and it is important to start early programs to prevent obesity. In literature is well described that overweight or obese children are more likely to become obese adults [1], and to lose the excess weight in adulthood is more difficult, especially when they become obese. New drugs and bariatric procedures for treating obesity-related health problems have emerged but these procedures are costly and have their own complications [2].

In Europe, the state of being overweight is becoming more prevalent in children of all ages [1], and, according to the World Health Organization (WHO), overweight and obesity are the most important public health threats, associated with more deaths worldwide than underweight [3].

Recent estimates showed that over 30% of children in the United Kingdom (UK) are overweight or obese [4]. A Swedish study, conducted on 4-year-old children, highlighted that 15 % of them are overweight and 3–4 % are obese [5]. Another investigation conducted in Germany, showed that 3% of 3- to 6-year-old children and even 6.4% of 7- to 10-year-olds could be defined as obese, while 6% and 9% of these groups, respectively, are overweight [6]. The last study conducted in Tuscany, instead, reported that the prevalence of overweight is 19.66% and the prevalence of obesity is 7.6% [7].

Several strategies should be implemented in order to contrast this phenomenon from perinatal period to adolescence [8–10]. In particular it is important: in the preschool period, to provide nutritional education to parents and children [11]; while in the childhood to monitor both the weight and height, preventing excessive prepubertal adiposity, to provide nutritional counselling, and to encourage daily physical activity [12].

The role of parents in children's obesity is indispensable: as shown in a previous study, for example, the probability of a child having a high Body Mass Index (BMI) was significantly increased if either the mother or the father was overweight/obese [13].

In particular the perception that they have of their children's nutritional status is a well recognized risk factor: in a prospective study, Kroke et al. showed that, during the study period, children whose weight was considered by their mothers too low gained more weight, and those who were considered to be too heavy lost more weight as compared to the children whose weight was considered to be just right [14]. As the last Tuscan research published on this topic dates back to 2006, the aim of our study was to investigate, after 10 years, mothers' perceptions of their children's nutritional status, the level of agreement between the mothers' perceptions of the rating of their children's nutritional status, and the factors that affect mothers' non correct identification of children's nutritional status.

METHODS

Study Design

In this study we reported data regarding the 2016 "OKKIO alla Salute" Tuscany Regional survey. In our region, to guarantee the maximum level of territorial coverage, all three Local Health Units were invited, and all agreed to join, and collaborate in, the project. Once enrolled, all three Local Health Units met for an explanation of the protocol and to arrange the operational formalities of the activities in Tuscany. With the support and assistance of the Ministry of Education, University and Research, the lists of public and private schools and classes with the number of children in each class were obtained from regional school authorities. A stratified cluster sample design was used, following WHO cluster survey methodology [15] with classes as the sampling unit.

Approval of the protocol was obtained from the institutional review board of the National Institute of Health, including the use of opt-out consent; that is, parents could refuse participation but the lack of a returned form was taken to imply consent to their child's participation.

We enrolled in our study 1449 children (744 boys, 705 girls) children and their mothers. Further details on this project were described elsewhere [16, 17]. This sample was further modified by eliminating the missing data of the current subject items in this survey and by taking only the questionnaire filled in by mothers. The data were obtained measuring and interviewing children attending the third grade of primary school and their parents.

Variables

In order to examine the mothers' perceptions of the nutritional status of their children, we asked them to respond to the following questions:

1. "According to you, your child is ..." by giving 1 of 4 possible responses: "underweight, normal weight, a bit overweight, very overweight"
2. "In your opinion your child eats..." by giving 1 of 3 possible responses: "little, the right, a lot".

Additional information was collected on the mothers' age and educational level classified as low (mothers had elementary, middle school or below) and high (mother had high school and college diploma). Maternal BMI was based on the mothers' self-reported height and weight; the validity of this method in adults has been established, and their BMI was categorized according to WHO criteria [18]. Specifically trained personnel using appropriate and standardized instruments measured the children's height and weight. The weight scale had an accuracy of 100 g. Height was measured with a portable stadiometer, with a precision of 0.1 cm; exact decimal age was calculated from the date

of birth and day of measurement. BMI was then calculated from weight and height, using the following formula: weight (kg)/height (m²). BMI classes of the children were set using the Cole et al. method [19]; this allowed us to have specific cut-off points for males and females at every age as recommended by the International Obesity Task Force (IOTF). In particular, BMI was divided into 4 levels: underweight, normal weight, overweight, obese. Then, children BMI and mothers' opinion were put in relation and a dichotomous variable was created (misclassification vs. correct classification).

Statistical analysis

Data were analysed using R version 3.3.3. Bivariate analyses of categorical variables were conducted with χ^2 tests at a significance level of 0.05. In order to quantify the level of agreement between the mothers' perceptions of the rating of their children's nutritional status (assessed from responses to the question "According to you, your child is ...") and the real children' BMI classified according to Cole [19], we calculated the proportion of overall agreement and the κ -Cohen ($\kappa < 0.40$ fair agreement; $0.40 < \kappa < 0.60$ moderate agreement; $\kappa > 0.60$ substantial agreement).

Results

This study examined a final sample of 1449 children (744 boys, 705 girls). The total number of questionnaires completed by the mothers was 1514. The total non-response rate was 11.10%. The main reason for exclusion

is due to the omission of the educational level of the mothers (5.16% non-response rate) and the BMI (rate of non-response of 4.95% for children and 7.4% for mothers). The other questions of interest to our study had an average rate of no answer of 3%. Children's characteristics were shown in Table 1.

In Table 2 children's BMI and mothers' perceptions were compared.

74.12% of mothers were able to correctly identify children BMI, 2.97% of them overestimated children's BMI (mothers reported superior nutritional status), 22.91% of them underestimated it (mothers reported inferior nutritional status). Even if the overall agreement was 74.12%, κ -Cohen was equal to 0.44 (Standard Error=0.02; $p=0.001$) which indicates moderate level of agreement.

In Table 3, the association between non correct classification and mothers' educational level was evaluated.

Non correct classification tends to significantly decrease in presence of a high educational level compared to low educational level (22.69% vs 35.37%). Mothers' BMI seems to not be associated with the non correct classification (p -value=0.08). The non correct classification was significantly associated with mothers' opinion on eating. In particular, mothers who declared their children eat either little or a lot tended to misclassify children's class of BMI, on average in 40% of cases, compared to mothers who did not.

Discussion

The results that we reported confirmed that a significant percentage of mothers (almost 23%) tend to misclassify the

TABLE 1. Characteristics of our sample.

	N	%
Gender		
Boys	744	51.34
Girls	705	48.74
Age		
Less than 7	3	0.20
8	896	61.83
9	548	37.81
More than 10	2	0.13
BMI		
Underweight	12	0.83
Normal weight	1041	71.84
Overweight	297	20.49
Obese	99	6.83

TABLE 2. Comparison between mothers' perception and real children's BMI.

	CHILDREN BMI			
	Underweight	Normal weight	Overweight	Obese
Mothers' perception				
Underweight	9 (75%)	120 (11.53%)	1 (0.34%)	0
Normal weight	3 (25%)	882 (84.73%)	126 (42.42%)	2 (2.02%)
Overweight	0	38 (3.65%)	169 (56.90%)	83 (83.84%)
Obese	0	1 (0.09%)	1 (0.34%)	14 (14.14%)

TABLE 3. Association between the non correct classification of children's nutritional status and mothers' educational level, mothers' BMI, and mothers' opinion on children's eating habit.

	RIGHT CLASSIFICATION	NON CORRECT CLASSIFICATION	P-VALUE
Mothers' educational level			<0.0001
Low	212 (64.63%)	116 (35.37%)	
High	787 (77.31%)	231 (22.69%)	
Mothers' BMI			0.08
Under-Normal weight	768 (75.59%)	248 (24.41%)	
Overweight	186 (68.89%)	84 (31.11%)	
Obese	45 (75%)	15 (25%)	
Mothers' opinion on eating			<0.0001
Little	109 (60.89%)	70 (39.11%)	
The right	796 (78.81%)	214 (21.19%)	
A lot	94 (59.87%)	63 (40.13%)	

nutritional status of their children. However, our results are not in line with the literature.

In a recently published Arabian study, authors found that 72% and 73.7% of mothers in the two examined cities (Tabouk and Riyadh), respectively, perceived their children to be underweight when their BMI was normal [20].

Rietmeijer and Paluis (2013) [20, 21], reported that 47.7% of children were incorrectly perceived as having normal weight by their parents.

Maynard et al. in 2003 observed that nearly one third of mothers misclassify overweight children as being lower than their measured weight status, while Baughcum et al. in 2000, affirmed that 79% of mothers failed to perceive their overweight child as overweight [22, 23].

So, although the percentage that we reported could appear to be high, it's far from the percentages of the studies cited above and these data are encouraging. However, it

would be better to be aware that, as reported by Lundahl et al. in 2014, the proportion of mothers who express concern about their overweight child being overweight in the future is not so high, particularly if their children are males, because of the wrong expectation of boys being 'big' compared with girls [24]. It is therefore essential to concentrate further efforts to educate the percentage of mothers who incorrectly classifies their children.

In our study we observed also that the non correct classification tends to significantly decrease in presence of a high educational level compared to low educational level. These findings were confirmed by Vázquez et al. (2013) that reported that a low maternal educational level, together with other risk factors, could encourage the development of risk behaviours for health in children, such as obesity [25]. This phenomenon reached a dramatically level in a study conducted in Poland, where, analyzing

mother's education, the percentage of obese subjects increased more than twofold in the elementary education group [26].

It is interesting to note that, in our samples, mothers' BMI seems to not be associated with misclassification. Several studies in literature in fact reported that childhood obesity is markedly correlated with the mother's BMI [27] and in some of them mothers' BMIs have been recognized as strong predictors of children's BMIs [28]. Obese parents are more likely to have overweight or obese children, compared to normal-weight parents and it has been suggested that parental excess weight has an important role on child BMI [29]. A previous published Italian study highlighted that the prevalence of obese children increases along the parents' BMI category: from 1.4% for underweight mothers to 30.3% for obese mothers and from 4% for under-normal-weight fathers to 23.9% for obese fathers [30].

Our results demonstrated that the non correct classification was significantly associated with mothers' opinion on eating habit. In particular, mothers who declared their children eat either little or a lot tended to misclassify children's nutritional status, compared to mothers who did not. A study conducted in Arabia has well described this phenomenon, showing how mothers with good dietary knowledge are more likely to teach their children about healthy food choices and tend to have normal weight. Mothers with a better knowledge tend to provide their children with a healthier diet (e.g., vegetables, fruit, juices, and fewer soft drinks and fast foods) than the mothers with lower knowledge about nutrition [20].

Strengths and limitations

The sample size, including a large number of children surveyed together with their mothers represents a strength. Nevertheless, some limitations should be reported. First, the assessment of perceived children's weight was conducted using a questionnaire. Other instruments have been developed and some of them include figures to make comparisons. Although it has been suggested that the use of images-based scales could improve the accurate recognition of overweight children, it is not enough to draw a definitive conclusion. We did not perform a multivariate analysis: this represents the last limitation.

In conclusion, our findings highlighted the importance of mothers perception of their children's BMI and showed that, in Tuscany, a significant (although lower than other studies) percentage of mothers tend to misclassify it. Numerous factors are responsible of this misclassification, especially mothers' education level and mothers' perception of their children's eating habit.

The implementation of family-centered preventive programs, and a mothers-centered education could be the key elements to contrast childhood obesity.

References

1. Lazzeri G, Casorelli A, Giallombardo D, Grasso A, Guidoni C, Menoni E, et al. Nutritional surveillance in Tuscany: maternal perception of nutritional status of 8-9 y-old school-children. *Journal of preventive medicine and hygiene*. 2006;47 (1):16-21.
2. Pandita A, Sharma D, Pandita D, Pawar S, Tariq M, Kaul A. Childhood obesity: prevention is better than cure. *Diabetes, metabolic syndrome and obesity : targets and therapy*. 2016;9:83-9.
3. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organization technical report series*. 2000;894:i-xii, 1-253.
4. Parkinson KN, Reilly JJ, Basterfield L, Reilly JK, Janssen X, Jones AR, et al. Mothers' perceptions of child weight status and the subsequent weight gain of their children: a population-based longitudinal study. *International journal of obesity*. 2017;41 (5):801-6.
5. Bergstrom E, Blomquist HK. Is the prevalence of overweight and obesity declining among 4-year-old Swedish children? *Acta paediatrica*. 2009;98 (12):1956-8.
6. Kurth BM, Schaffrath Rosario A. [The prevalence of overweight and obese children and adolescents living in Germany. Results of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS)]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*. 2007;50 (5-6):736-43.
7. Troiano G, Simi R, Mercurio I, Alfonso MG, Trombetta CM, Manini I, et al. "OKKIO alla salute 2014" results from the Tuscan sample. *Annali di igiene : medicina preventiva e di comunita*. 2018;30 (4):259-72.
8. Barlow SE, Expert C. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120 Suppl 4:S164-92.
9. Contento IR, Basch C, Zybert P. Body image, weight, and food choices of Latina women and their young children. *Journal of nutrition education and behavior*. 2003;35 (5):236-48.
10. Gillman MW, Rifas-Shiman SL, Camargo CA, Jr., Berkey CS, Frazier AL, Rockett HR, et al. Risk of overweight among adolescents who were breastfed as infants. *Jama*. 2001;285 (19):2461-7.
11. Hediger ML, Overpeck MD, Kuczumarski RJ, Ruan WJ. Association between infant breastfeeding and overweight in young children. *Jama*. 2001;285 (19):2453-60.
12. McArthur LH, Anguiano R, Gross KH. Are household factors putting immigrant Hispanic children at risk of becoming overweight: a community-based study in eastern North Carolina. *Journal of community health*. 2004;29 (5):387-404.
13. Lindkvist M, Ivarsson A, Silfverdal SA, Eurenus E. Associations between toddlers' and parents' BMI, in relation to family socio-demography: a cross-sectional study. *BMC public health*. 2015;15:1252.
14. Kroke A, Strathmann S, Gunther AL. Maternal perceptions of her child's body weight in infancy and early childhood and their relation to body weight status at age 7. *European journal of pediatrics*. 2006;165 (12):875-83.
15. Bennett S, Woods T, Liyanage WM, Smith DL. A simplified general method for cluster-sample surveys of health in developing countries.

- World health statistics quarterly Rapport trimestriel de statistiques sanitaires mondiales. 1991;44 (3):98-106.
16. Lazzeri G, Panatto D, Pammolli A, Azzolini E, Simi R, Meoni V, et al. Trends in overweight and obesity prevalence in Tuscan schoolchildren (2002-2012). *Public health nutrition*. 2015;18 (17):3078-85.
 17. Lauria L, Spinelli A, Cairella G, Censi L, Nardone P, Buoncristiano M, et al. Dietary habits among children aged 8-9 years in Italy. *Annali dell'Istituto superiore di sanita*. 2015;51 (4):371-81.
 18. Nuttall FQ. Body Mass Index: Obesity, BMI, and Health: A Critical Review. *Nutrition today*. 2015;50 (3):117-28.
 19. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj*. 2000;320 (7244):1240-3.
 20. Maha Mohammad Al Balawi MFAH, Sahar Mohammed Hassan Yakout. Maternal Perception of Body Mass Index and Dietary Habits Leading to Obesity Among Saudi School Aged Children a Comparative Study *World Journal of Public Health* 2018;3 (1):23-31.
 21. Rietmeijer-Mentink M, Paulis WD, van Middelkoop M, Bindels PJ, van der Wouden JC. Difference between parental perception and actual weight status of children: a systematic review. *Maternal & child nutrition*. 2013;9 (1):3-22.
 22. Baughcum AE, Chamberlin LA, Deeks CM, Powers SW, Whitaker RC. Maternal perceptions of overweight preschool children. *Pediatrics*. 2000;106 (6):1380-6.
 23. Maynard IM, Galuska DA, Blanck HM, Serdula MK. Maternal perceptions of weight status of children. *Pediatrics*. 2003;111 (5 Pt 2):1226-31.
 24. Lundahl A, Kidwell KM, Nelson TD. Parental underestimates of child weight: a meta-analysis. *Pediatrics*. 2014;133 (3):e689-703.
 25. Vazquez-Nava F, Trevino-Garcia-Manzo N, Vazquez-Rodriguez CF, Vazquez-Rodriguez EM. Association between family structure, maternal education level, and maternal employment with sedentary lifestyle in primary school-age children. *Jornal de pediatria*. 2013;89 (2):145-50.
 26. Koziel S, Kolodziej H, Ulijaszek SJ. Parental education, body mass index and prevalence of obesity among 14-year-old boys between 1987 and 1997 in Wroclaw, Poland. *European journal of epidemiology*. 2000;16 (12):1163-7.
 27. Quek CM, Koh K, Lee J. Parental body mass index: a predictor of childhood obesity? *Annals of the Academy of Medicine, Singapore*. 1993;22 (3):342-7.
 28. Bralic I, Vrdoljak J, Kovacic V. Associations between parental and child overweight and obesity. *Collegium antropologicum*. 2005;29 (2):481-6.
 29. Shafaghi K, Shariff ZM, Taib MN, Rahman HA, Mobarhan MG, Jabbari H. Parental body mass index is associated with adolescent overweight and obesity in Mashhad, Iran. *Asia Pacific journal of clinical nutrition*. 2014;23 (2):225-31.
 30. Lazzeri G, Pammolli A, Pilato V, Giacchi MV. Relationship between 8/9-yr-old school children BMI, parents' BMI and educational level: a cross sectional survey. *Nutrition journal*. 2011;10:76.

